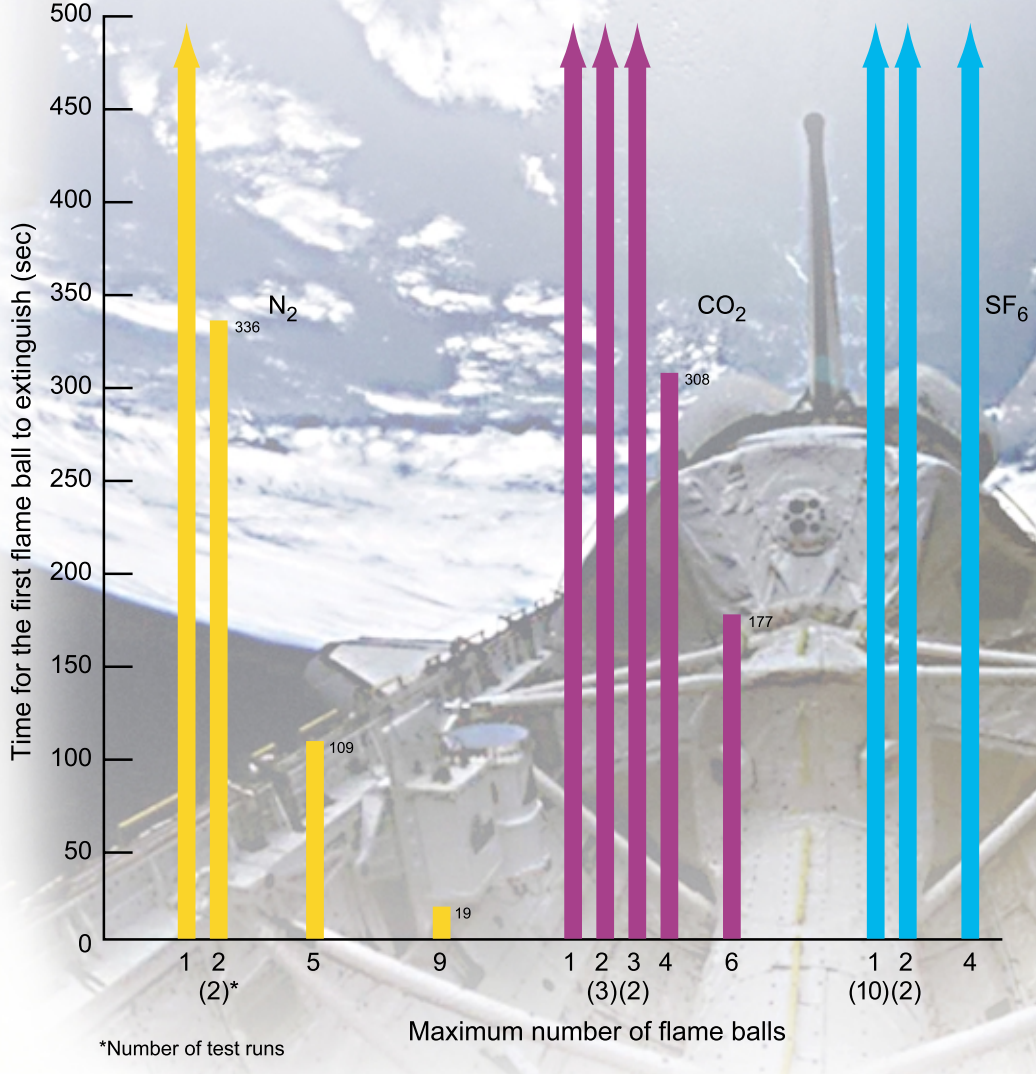
Glenn Research Center

Flame Ball Lifetimes



◆ Why do flame balls in N_2 burn faster than the other diluents?

• The flame balls are larger, thus they have more area, and the mass diffusivity of H_2 in N_2 is larger than in CO_2 or SF_6. The rate of diffusion of fuel to the flame ball increases with increasing area and with increasing diffusivity. The more diffusion of fuel to the surface, the faster they consume the available fuel in the chamber.

◆ Why are flame balls in air larger than in other diluents?

• The flame radius is determined by a balance between the rate of diffusion of fuel to the ball surface (and thus the rate of heat release rate) and the rate of volumetric heat loss due to radiation.

• The radiative loss is much lower in H_2-air mixtures where the only radiator is H_2O.

• The flame balls in H_2-air are producing more heat per unit time and need more volume to lose this heat, so they have to be bigger.

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